Bird Track Springs Fish Habitat Enhancement Project

Hydrology, Floodplains, and Wetlands Report

Prepared for:

U.S. Forest Service
Wallowa-Whitman National Forest
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Table of Contents

Tables

Figures

1 Affected Environment

1.1 Introduction

The Bird Track Springs Fish Enhancement Project has two activity areas; an active project area where restoration activities would occur along the Upper Grande Ronde River (GRR) and a log source area on private property south of the main active project area (Figure 8). The project reach in the active project area is located on the GRR between river miles (RMs) 144.7 and 146.1 along Highway 244 near the Bird Track Springs Campground in the Wallowa-Whitman National Forest and on private land (Figure 1). The active project area ranges from 3,050 feet of elevation at the downstream end to 3,139 feet at the upstream end and drains an approximately 475-square-mile watershed that reaches a maximum elevation of 7,923 feet. The mean annual precipitation averages 26.2 inches, most of which falls as snow during winter months. Most of the basin is forested (over 73 percent) and has very little development (less than 0.1 percent estimated impervious area) (U.S. Geological Survey [USGS] 2014). The reach was identified in the Upper Grande Ronde River Tributary Assessment (U.S. Bureau of Reclamation [Reclamation] 2014) as an unconfined geomorphic reach with high potential to improve physical and ecological processes to support salmonid recovery.

The project reach is an unconfined alluvial channel with low sinuosity and little interaction with the floodplain when compared to historical conditions. Prior to Euro-American settlement, riparian vegetation would have included woody species such as cottonwood, willow, birch, and alder with adjacent upland areas supporting mature Ponderosa pine and Douglas-fir. Beaver were common and would have contributed to channel and floodplain complexity. The historical channel would likely have had an island-braided pattern with greater numbers of pools, riffles, logjams, woody material, and floodplain connectivity. (See Fisheries/Aquatics Resource report for more detail on habitat conditions, Kavanagh 2015, Cardno 2016a, Beechie et al. 2006.) Current geomorphic conditions in the project reach were surveyed and the results are illustrated in Figure 2 and described in Tables 1 and 2. Geomorphic reaches are labeled in Figure 2 and start at the upstream end of the project reach.

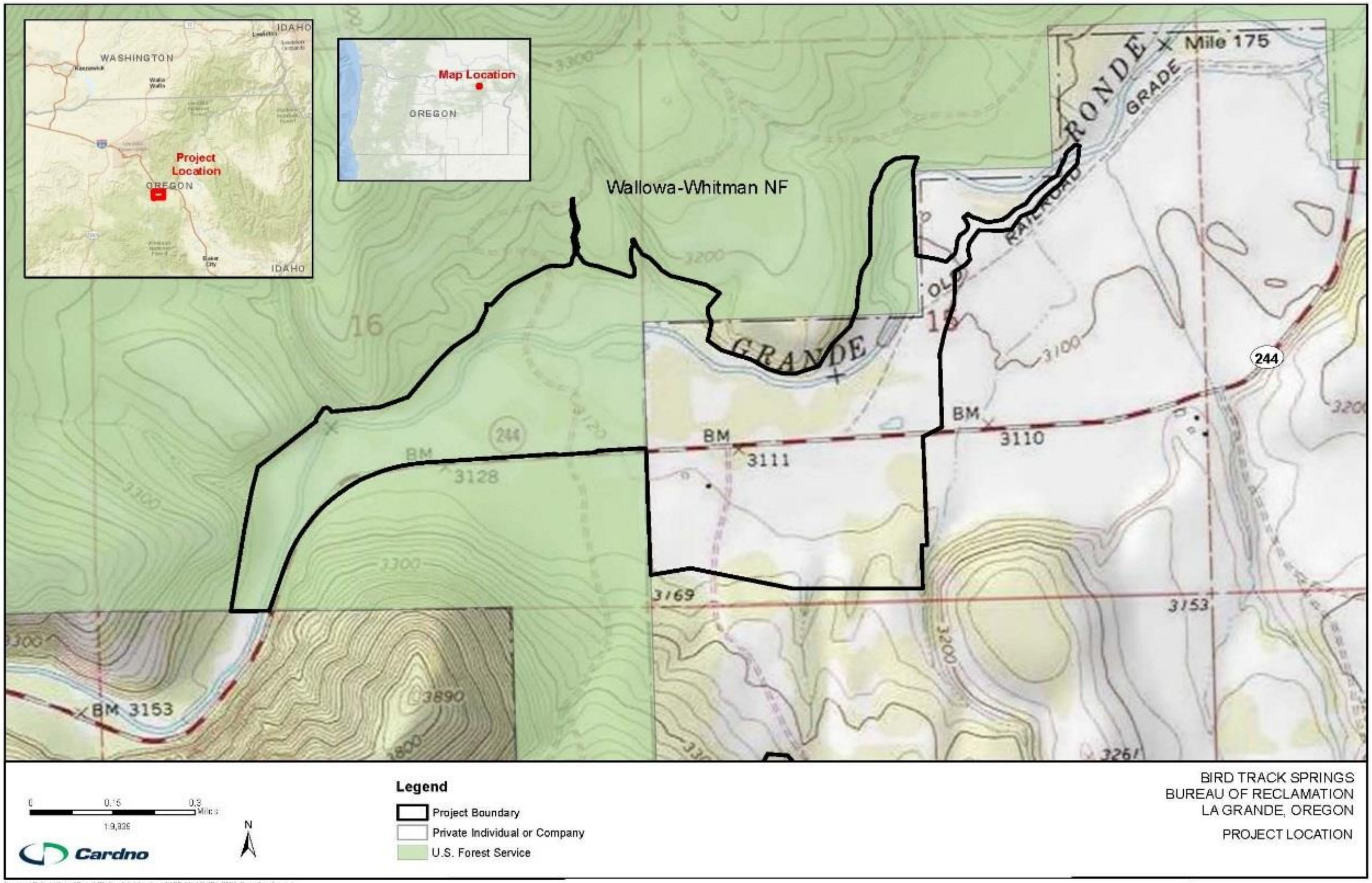

Figure 1. Active project area showing property ownership.

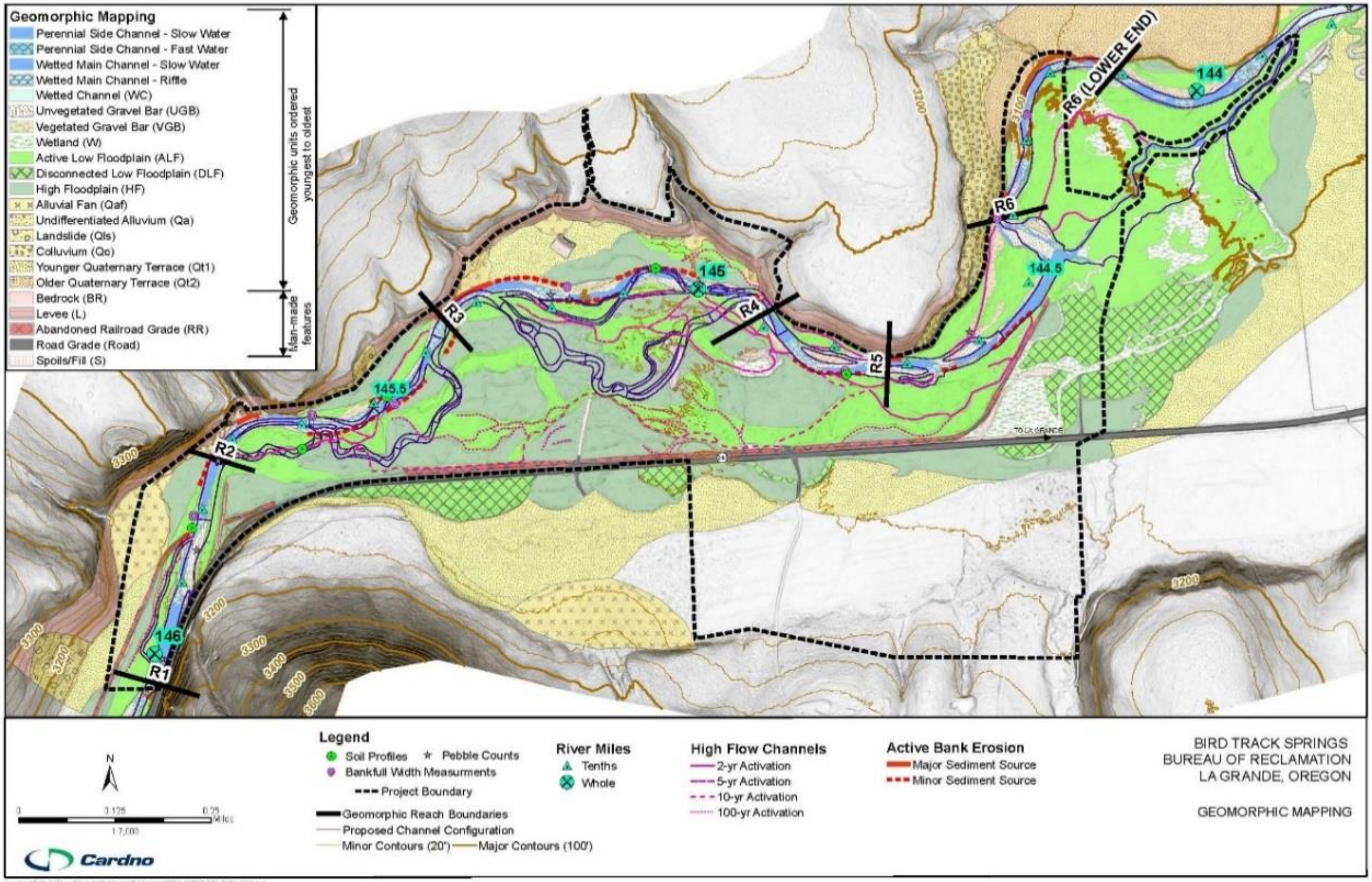

Figure 2. Overview geomorphic map of the project reach. Detailed inset maps are provided in the Appendix B of the Basis of Design Report.

Table 1: Geomorphic Reach Descriptions

Reach	Description
1 (upper end of project reach)	The GRR is moderately confined with a straight channel planform. Ice scour is a major process, while lateral channel migration and bank erosion are negligible. Key lateral constraints include a Highway 244 levee on the right bank and the historical railroad grade on the left bank. Historical log abutments from the historical railroad bridge are exposed in the channel bed along the left bank. Channel complexity is low as indicated by the lack of pools and general lack of woody debris.
2	The GRR is decreasingly confined relative to Reach 1, but intersects the bedrock valley wall on the left bank where a historical quarry is present. Downstream of the quarry and bedrock is an apparent abundance of angular cobbles and boulders, which wanes by the downstream end of the reach. Historical channel migration rates have been low to moderate, while ice scour is active. An existing high-flow channel (activated by 5-year flood) is present on the right bank, while additional high-flow channels currently activated only during 10- and 100-year floods extend downstream along the right valley. Channel complexity is low as indicated by the lack of pools and general lack of woody debris.
3	The GRR is unconfined with a sinuous planform. Historical channel migration rates have been relatively high, which has helped to create surfaces for cottonwood recruitment. Recent cottonwood recruitment occurred within the upper reach within the last 10 years. Ice scour processes, if active, are not apparent from vegetation indicators. An alluvial fan and river terrace remnant on the left bank are major sediment sources. Existing high-flow channels on the right activate at 2- and 5-year intervals. An alcove on the right bank has a strong groundwater/hyporheic temperature signature in the summer, and was observed to be ice-free in winter 2016 during a period when the river channel was largely frozen otherwise. Channel complexity, as indicated by area and prevalence of wetted off-channel features, is improved relative to reaches 1 and 2.
4	The GRR is unconfined with a sinuous planform. Historical channel migration has occurred at moderate rates. Low, active floodplain extends for the reach entirety on the left bank, whereas high floodplain is present on much of the right bank. On the left bank, existing off-channel features include a high-flow channel (2-year activation) and wetland. This wetland exhibits a subtle temperature signature of hyporheic upwelling. On the right bank, an excavated pond/wetland is located in the upper reach, and a high-flow channel (2-year activation) departs from the main channel in the lower reach.
5	The GRR is unconfined and dynamic in this reach, with shifting bars and a meandering to braided planform. Historical channel migration rates have been high, and have generally involved bend growth and channel switching between the existing main channel and high-flow channel on the left. The main channel longitudinal profile exhibits a significant decrease in slope in the upper two-thirds of the reach, at which point the channel steepens and turns abruptly to the northwest. A perennial side channel diverges from the main channel at this sharp bend, and is a priority for preservation. While this side channel is connected to the main channel at the surface, temperature mapping indicates that groundwater is the primary source. The main channel is braided with multiple channels and shifting bars below the bend. The historical (abandoned) railroad grade is present in the right floodplain. The high-flow channel on the left is activated in the 2-year flood and has adjacent ponds wetted during low-flow conditions. Temperature signatures in these ponds indicate either groundwater or hyporheic connection). In addition, indications of hyporheic upwelling are present along the downstream end of the high-flow channel at its convergence with the main channel.
6 (Downstream end of project reach)	The GRR is unconfined, but runs along the northern valley wall for much of its length. The valley wall is composed of the bedrock-cored hillslope in the upper portion of the reach, and an older river terrace in the lower reach. This river terrace (Qt2) appears to be older than the Mount Mazama eruption, and is largely composed of fluvial sand and gravels, overlain by hillslope-derived silts and sands. At the base of this terrace (underlying fluvial deposits) are indurated silts and sands resembling weakly cemented bedrock. This exposed sedimentary unit is likely the base of the hillslope bedrock (over which the terrace has been deposited), or a bedrock-cored river terrace. Deep pools are present in the main channel where it impinges upon the terrace at sharp bends. This terrace, while erosion resistant, appears to have retreated historically with fluvial erosion, suggesting this reach provides sediment to the Longley Meadows project reach downstream. Away from valley walls, the channel runs entirely through active, low floodplain area.

Source: Cardno 2016a

Table 2: Key Channel and Streambank Characteristics by Geomorphic Subreach

Subreach	Length	Slope	Average Riffle Spacing		Ratio of Riffle Length to Slow Water Unit (run, glide, or pool) Length	# Slow Water Units with >1-foot Residual Depth	% Bar Area	% Eroding Banks
ID	ft	ft/ft	ft	xBFW*	-	#	% of Active Channel	% of Total Bank Length
1	1,631	0.0036	631	6.51	0.71	0	28%	12%
2	2,086	0.0046	460	4.75	1.14	0	17%	35%
3	2,477	0.0046	495	5.11	0.72	2	33%	44%
4	1,034	0.0045	517	5.33	0.83	0	36%	28%
5	2,104	0.0037	444	4.58	0.36	1	38%	14%
6	1,663	0.0045	554	5.71	0.36	1	27%	38%
Total	10,995	0.004	509	5.25	0.64	4	0.31	0.29

Source: Cardno 2016a

* Multiples of bankfull width

Minimum and maximum values for each metric are shown in green and red, respectively.

Icing is a significant process during winter low flows, and has likely been exacerbated by the current wider and shallower channel geometry. Scarred trees are present in the upper 3,000 feet of the channel and provide a conservative estimate on longitudinal ice scour extent.[1] These trees show height of scour occurring consistently above the 100-year water surface elevation. Surface ice accumulation can be significant during winter months to the point of creating large ice dams. The formation of ice dams and their subsequent failure can scour the stream bed and damage banks and riparian vegetation.

1.2 Hydrology

Flows in the upper GRR are not impacted by dam-imposed flow regulation. Some irrigation diversions exist, primarily affecting flows during irrigation season. In general, the annual hydrograph is dominated by snowmelt-derived high flows in April and May, with peak flows also occurring occasionally due to winter rain storms. The low-flow season typically extends from August through November. A detailed hydrologic analysis was conducted for the project and is summarized below (Cardno 2016a, Appendix C). Recurrence interval flows were estimated for 1.05 to 500-year peak flows and flow duration curves were estimated from gauges near the project site or from regional regression equations. Table 3 lists the gauges used in the analysis, their location on the river, drainage area, and period of record. In addition, flows were measured during the summer of 2015 to better calibrate low-flow estimates.

[1] Due to limited mature downstream vegetation

Table 3: Stream Gauges in the GRR Basin used in the Hydrologic Analysis

Station Number	Name	Agency	River Mile	Drainage Area (mi^2)	Start Year	End Year
13319000	Grande Ronde R at La Grande, OR	USGS	132	686	1903	1989
13318960	Grande Ronde R Near Perry, OR	OWRD	135.9	677	1997	Current
13318920	Five Points Cr at Hilgard, OR	OWRD	137.7	71.9	1992	Current
13318800	Grande Ronde R at Hilgard, OR	USGS	139.3	544	1966	1981
13318500	Grande Ronde R Near Hilgard, OR	USGS	142.9	495.7	1937	1956

Figure 3 is a reconstructed flow record based on records from the historical USGS gauge located at RM 142.9 downstream of the project reach (Station 13318500). The short period of record (1937–1956) has been augmented with flow records from other gauges adjusted to match that gauge location. The figure shows mean monthly flows for the augmented period of record along with estimates of annual peak flows. A few data gaps still exist in the record in the early 1900s and the 1990s.

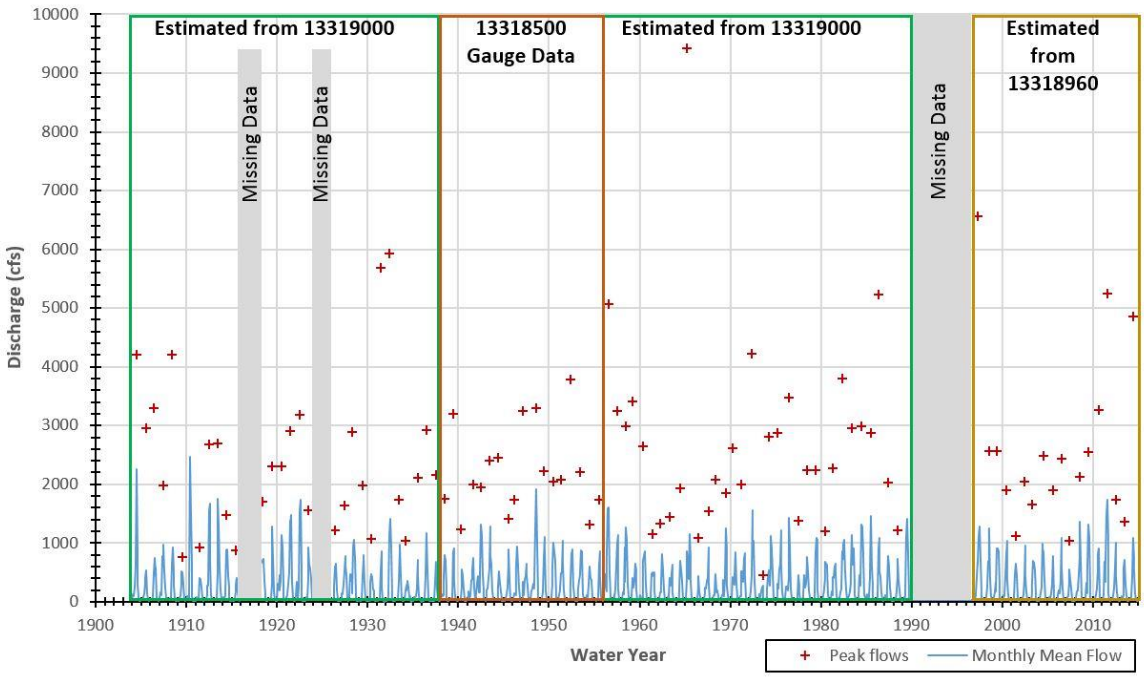

Figure 3. Reconstructed flow record for water years 1904–2015 for the historical gauge at RM 142.9 below the project reach. The reconstructed record includes measured flows from 1938–1956, and drainage area adjusted flows from the USGS gauges at La Grande (13319000) and Perry (13318960). Years with missing data include 1910, 1916–1917, 1924–1925, and 1989–1996.

Table 4 displays estimated monthly and annual flows for the 5 percent exceedance discharge (high flows exceeded 5 percent of the time in a given month based on the period of record), the 50 percent exceedance discharge (the median monthly flow), and the 95 percent exceedance discharge (low-flow conditions where flows are expected to be higher 95 percent of the time) estimated at the upstream project boundary at RM 146.1. Trends in the flow data over the period of record were reviewed to see if change had occurred in discharges and peak flows. The results indicate a slight increase in the median and 95 percent exceedance (i.e., low) flows on the upper GRR, although the statistical significance of the increase was not tested. Three out of four local weather stations showed a slight increase in mean annual precipitation and all four stations showed a slight increase in mean annual temperature over the period of record (since 1895).

Table 4: Exceedance Statistics for Flows Estimated at the Upstream Project Boundary at RM 146.1

Month	5 percent exceedance discharge (cfs)	50 percent exceedance discharge (cfs)	95 percent exceedance discharge (cfs)
October	68	25	15
November	168	37	19
December	383	58	19
January	515	83	30
February	671	148	47
March	1,395	412	89
April	1,697	725	276
May	1,645	634	183
June	1,083	221	65
July	204	54	16
August	49	20	9
September	40	19	12
Annual	1,079	77	14

The highest mean monthly flows occur in April and May, and two of the top 10 historical flood peaks occurred in May. The other eight historical peak flows occurred in January through March and were likely the result of a rain-on-snow storm events. The flood of record occurred January 30, 1965, as a result of a major warm rain event following a week of continuous rain and snow. The heavy rainfall in combination with antecedent conditions and a much higher freezing elevation caused record runoff. That peak is estimated at 8,741 cubic feet per second (cfs) at the upstream project boundary and would be between a 200-year and 500-year event based on return interval estimates at that location (Cardno 2016a, Appendix C). A slight increase in peak flows was noted over the period of record, but was not statistically tested (Cardno 2016a, Appendix C). Table 5 shows the flow estimates for various return intervals at the upstream project boundary.

Table 5: Return Interval Flows Estimated for the Upstream Project Boundary at RM 146.1

			95% Confidence Intervals	
Annual Probability	Return Interval (years)	Flow (cfs)	Low (cfs)	High (cfs)
0.95	1.05	957	838	1,069
0.9	1.1	1,122	998	1,240
0.8	1.25	1,368	1,238	1,495

Table 5: Return Interval Flows Estimated for the Upstream Project Boundary at RM 146.1

			95% Confidence Intervals	
Annual Probability	Return Interval (years)	Flow (cfs)	Low (cfs)	High (cfs)
0.6667	1.5	1,654	1,515	1,795
0.5	2	2,029	1,872	2,199
0.4292	2.33	2,212	2,042	2,401
0.2	5	3,072	2,813	3,393
0.1	10	3,847	3,477	4,333
0.04	25	4,922	4,367	5,685
0.02	50	5,791	5,069	6,812
0.01	100	6,719	5,805	8,042
0.005	200	7,713	6,580	9,386
0.002	500	9,141	7,675	11,360

The lowest flows of the year typically occur in the project reach in August and September (Table 4). Low flows are typically coupled with high temperatures, impacting salmonid species (Salinger and Anderson 2006). Much of the flow through the project reach during the low-flow season is subsurface, as described below in the Section 1.3. There is little evidence of groundwater contribution to low flows in this reach to moderate temperatures.

1.3 Groundwater

Anderson-Perry & Associates, Inc. and GSI Water Solutions, Inc. conducted the Upper Grande Ronde River Watershed Storage Feasibility Study for the Grande Ronde Model Watershed (Anderson Perry & Associates and GSI Water Solutions 2013). Their study area included the Bear Creek Subbasin, which is less than 0.5 mile downstream of the project reach. Boreholes in the vicinity of the Bear Creek Subbasin showed there was between 40 feet to over 100 feet of weakly cemented interbedded sandstone, siltstone, and gravel overlying basalt flows. The alluvial aquifer is a thin veneer of fluvial deposits overlying much older sedimentary and volcanic rock within a shallow, fault-bounded structural basin. The average residence time of water flowing through the alluvial aquifer is likely less than 1 year, a rate that is likely much shorter than the residence times in the underlying regional bedrock aquifer.

The hyporheic zone is the volume of saturated sediment surrounding the open channel flow. The water filling the pore space in the sediment of the hyporheic zone comes from the channel rather than a deep groundwater source. At the project reach, particularly during summer low flow, the entire valley bottom can be considered the hyporheic zone, bounded by the much less hydraulically conductive bedrock. Throughout the year, it does not appear that deep groundwater inputs add appreciably to discharge at this site; especially during summer low flow, the vast majority of water in the alluvial aquifer is of riverine origin.

1.4 Flooding

Bankfull discharge was estimated for the project reach as the 1.05-year return interval flow of approximately 957 cfs. Technically, these flows occur almost every year and higher flows would result in out-of-bank flows at some areas along the project reach, causing localized flooding. The modeled 10-year return interval flood would inundate approximately 69 acres or 24 percent of the active project area (Cardno 2016a). Overbank flows contribute to diverse riparian conditions and complexity, which tends to benefit salmonids.

1.5 Floodplain Overlay Zone

Article 17 of the Union County Planning Department regulations describes the Floodplain Overlay Zone and regulations regarding development in the floodplain (http://union-county.org/planning/). The rule requires development or building permits before construction or development occur in areas of special flood hazards as defined by the Federal Emergency Management Agency (FEMA) on the Flood Insurance Rate Maps (FIRM). Most of the regulations pertain to construction of buildings in the floodplain. The most recent FIRM for the active project area was published in 1980 and includes the entire active project area (Figure 4). The base flood elevations at this location have not been determined, but the estimated Special Flood Hazard Area includes the project area and extends beyond Highway 244. It should be noted that this flood map was produced using regional information and should only be considered for regulatory purposes rather than an accurate estimate of the extent of a 100-year flood event.

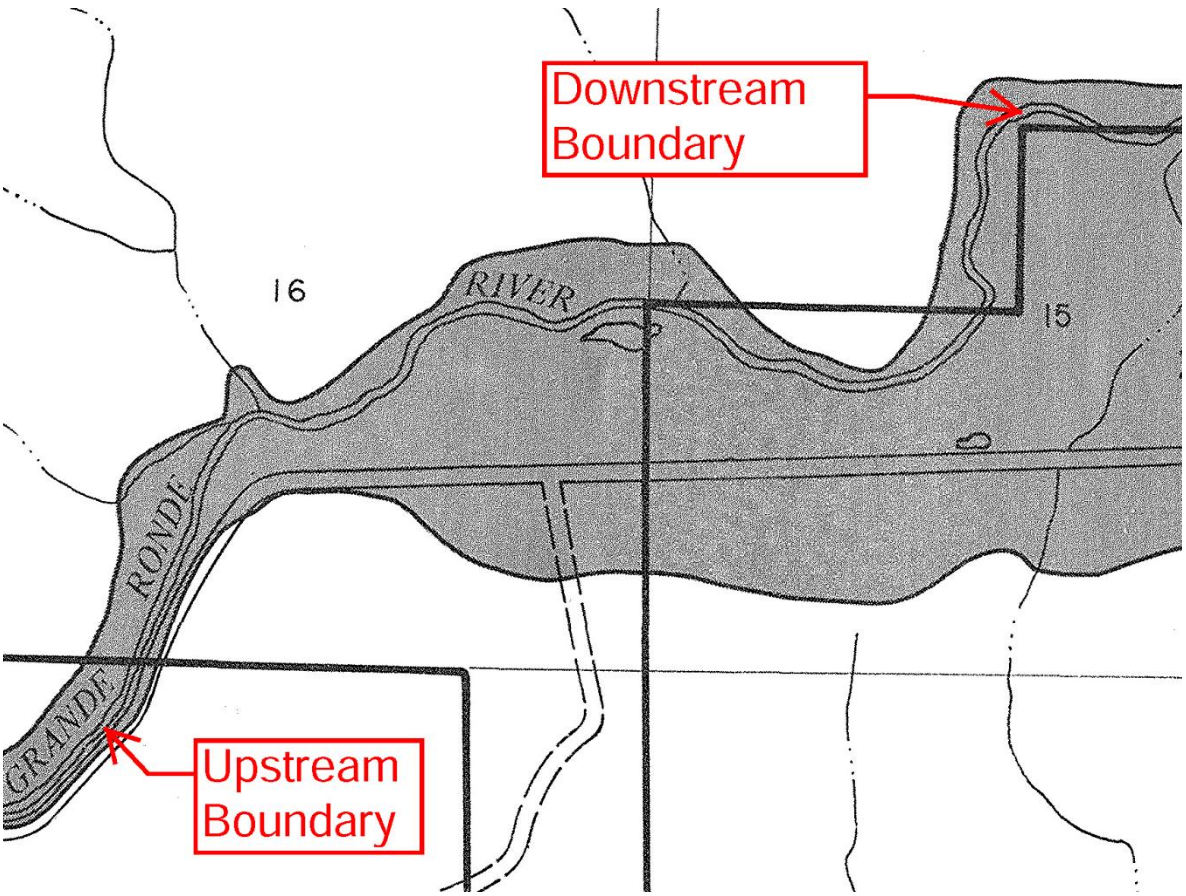

Figure 4. Close-up of the project area from Flood Insurance Rate Map 4102160275B, effective May 15, 1980. The grayed area is Zone A; areas of 100-year flood, base flood elevations, and flood hazard factors not determined.

1.6 Water Quality

The Oregon Department of Environmental Quality (ODEQ) has identified many stream segments within the Upper Grande Ronde Subbasin as water quality limited (ODEQ 2016, 2000). Water quality limited means instream water quality fails to meet established standards for certain parameters for a portion of the year and requires a total maximum daily load (TMDL) to be prepared to address pollutants. Oregon's 2012 303(d) List of Water Quality Limited Waterbodies identifies seven parameters for the Upper GRR within the project reach that do not meet standards: algae (TMDL approved), flow modification, habitat modification, pH (TMDL approved), phosphorous (TMDL approved), sedimentation (TMDL approved), and temperature (TMDL approved). A TMDL and Water Quality Management Plan were prepared for the Upper Grande Ronde Subbasin in 2000 because it does not meet state standards for temperature, dissolved oxygen, algae, nutrients, pH, sedimentation, bacteria, ammonia, and habitat and flow modification (Grande Ronde Water Quality Committee 2000; ODEQ 2000). Due to the predominance of non-point sources, the plan relies largely on habitat restoration to achieve the TMDL goals. Water quality parameters (and standards) of temperature (64 degrees Fahrenheit [°F]/55°F, rearing/spawning), dissolved oxygen (98 percent saturation), habitat modification (pool frequency), and flow modification (flows) relate to beneficial use for fish life (Northwest Power and Conservation Council 2004). Temperature and sedimentation are discussed in more detail below and pool-riffle ratios are discussed in the geomorphology section above (Table 2). Flows are discussed in the hydrology section. No data were available regarding dissolved oxygen levels in the project reach.

1.7 Temperature

In 2010, thermal infrared water temperature data was collected for the Upper GRR. This type of data indicates differences in water temperatures across a large area at one point in time so that relative temperatures can be compared. In general, temperatures decreased in the upstream direction with lower flows and higher elevation. Tributaries, particularly those flowing into the mainstem just downstream of the project reach, contributed water that was cooler by a 0.5 to 3 degrees Celsius (°C). Mainstem temperatures at the time of sampling were about 23°C. Surface water data were also collected at multiple locations in the project reach in August and September 2016 using temperature loggers (Figure 5). The temperature data show regular exceedances of the 64°F (17.8°C) criteria for rearing in the mainstem, although the temperatures show a declining trend through the monitoring period. Side channel temperatures are lower likely due to groundwater influence.

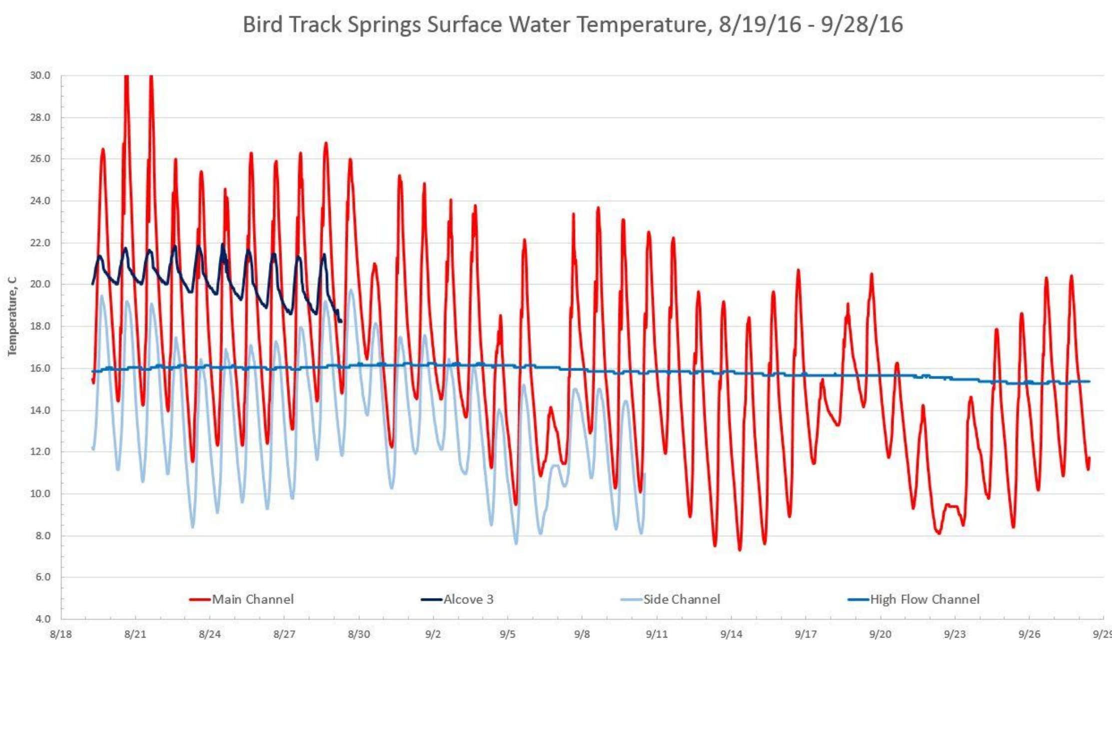

Figure 5. Surface water temperature measurements at four locations near the middle of the project reach in August and September 2016 (Cardno 2016a).

1.8 Sedimentation

Eroding banks within the project reach actively supply sediment to the GRR. Major and minor sources of sediment along actively eroding banks were mapped in the field and are shown in Figure 2. Minor sources are classified as any eroding banks mapped along floodplain geomorphic units, whereas major sediment sources were classified as eroding banks along alluvial fans, river terraces, and valley walls. Approximately 21 percent of the channel in the project area is subject to minor bank erosion and 8 percent is subject to major bank erosion (Cardno 2016a; Table 2). Active bank erosion is most predominant in the middle project reach and at the lower end of the project reach. In general, the channel character does not appear to change in direct response to local sediment inputs except where the channel intersects a bedrock valley wall and the historical quarry, which is a major sediment source. Extending downstream from the quarry for approximately 1,000 feet is a zone of increased abundance of angular cobble and boulder-sized grains (Cardno 2016a; Kavanagh 2015).

1.9 Wetlands

National Wetlands Inventory (NWI) data were available for the project area and are depicted in Figure 6. Field investigations were conducted in June of 2016 to identify wetlands within the active project area and the results are also indicated in Figure 6. The NWI layer is developed at a regional level and is not considered sufficiently accurate for site-specific project-level work. As indicated on the map, there is some overlap between the NWI layer and the field-surveyed wetlands, but the site-specific wetland survey will be used in this analysis.

Three primary types of wetland resources were identified from fieldwork within the active project area: Type 1) unvegetated riverine Other Waters (the GRR), Type 2) vegetated Other Waters (riparian corridor of the GRR), and Type 3) floodplain wetlands (floodplain/depressional wetlands) (Cardno 2016b). Table 6 describes the wetlands mapped within the active project area and their corresponding Cowardin classifications. Functions of these wetlands include protection and armoring of the banks of the GRR, mechanical filtration, chemical filtration, energy dissipation during high-flow events, and a high capacity to support resident wildlife including fish, fish spawning, and fish rearing habitat.

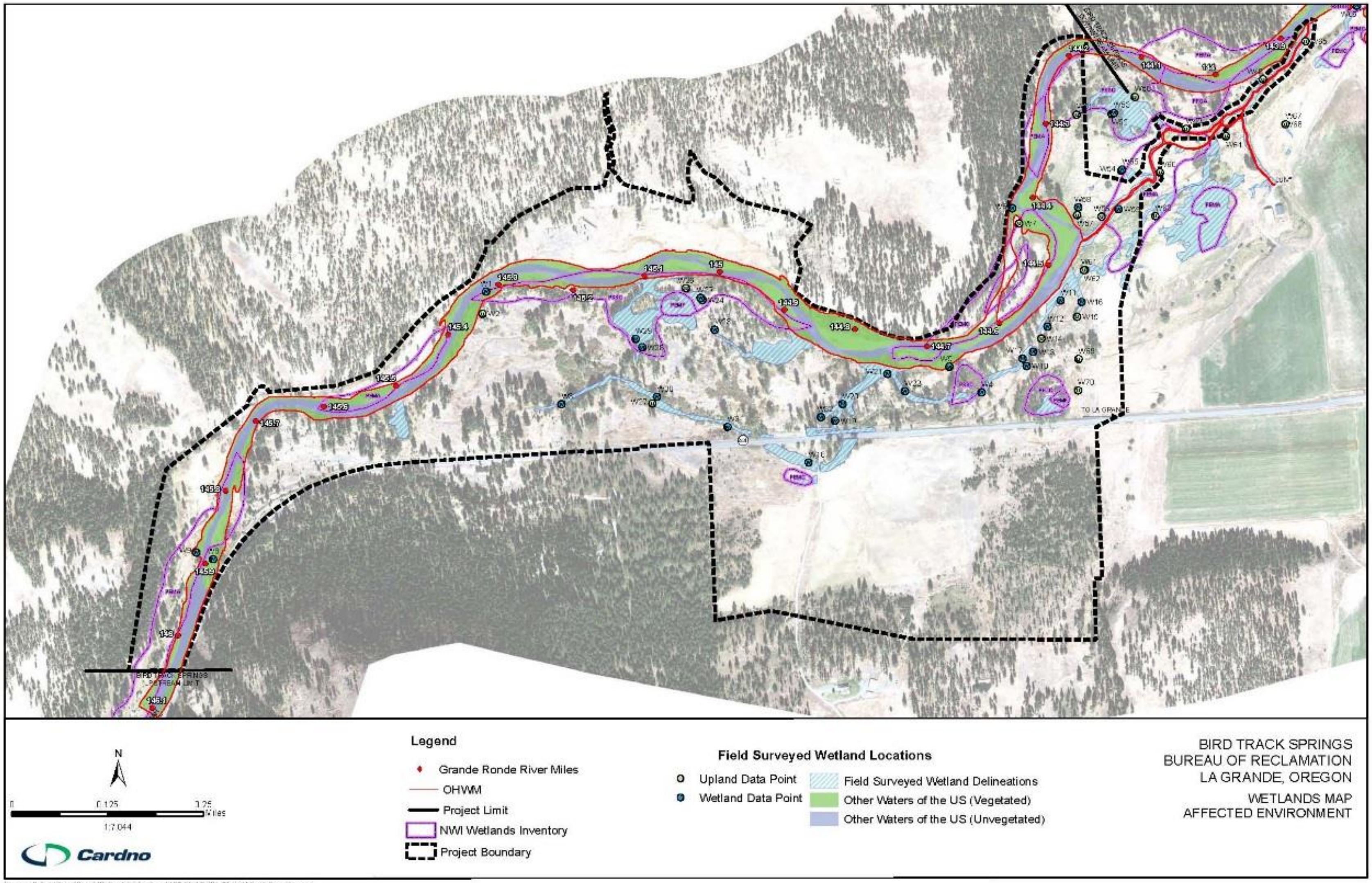

Figure 6. Map of the active project area showing NWI wetlands and field-surveyed wetlands.

Table 6: Field-mapped Wetlands within the Active Project Area

Type	Description	Acres	Description	Cowardin Classification
1	Unvegetated Riverine Other Waters	13.0	Located within the active channel of the GRR, below the field-observed ordinary high water mark (OHWM). All unvegetated areas within the OHWM were inundated by surface water. Classified as RIVERINE wetlands under the 2008 U.S. Department of Agriculture (USDA) hydrogeomorphic (HGM) wetland classification system (USDA 2008).	Unvegetated portions of the GRR would be classified as R3UB1H; Riverine (R) Upper Perennial (3) Unconsolidated Bottom (UB) Cobble-Gravel (1) Permanently Flooded (H). This area is located within the wetted portion of the river channel. Low, unvegetated mid-channel bars would also be classified at R3UB1 with a modifier of C, E, F, G H, or J (Seasonally Flooded, Seasonally Flooded/Saturated, Semi-permanently Flooded, Intermittently Exposed, Permanently Flooded or Intermittently Flooded).
2	Vegetated Other Waters	21.4	Herbaceous and shrub-scrub wetland vegetation communities commonly colonized the low banks and water bars within the OHWM of the GRR. These areas were evaluated as potentially jurisdictional wetlands owing to the presence of established hydric vegetation and indicators of hydrology. All sites were located within the OHWM of the GRR, and showed primary indicators of hydrology such as surface water, high water table, and/or saturation. Drift deposits and inundation visible on aerial imagery was also recorded. For the purposes of this delineation, Vegetated Other Waters were considered potentially jurisdictional wetlands based on a prevalence of semi-permanent wetland vegetation, frequent inundation and indicators of hydric soil. However, because these areas are within the OHWM, they are subject to fluvial processes such as frequent scour and deposition, and therefore could be considered transient communities. Classified as RIVERINE wetlands under the 2008 USDA HGM wetland classification system (USDA 2008).	Vegetated areas including the river margin and mid-channel or point bars were classified as Palustrine Emergent (PEM) or Palustrine Scrub-Shrub (PSS) based on predominance of shrub and/or herbaceous vegetation at each location. Modifiers for Water Regime would likely be Temporarily Flooded (A), Saturated (B), or Seasonally Flooded (C) based on the site-specific water regime.
3	Floodplain Wetlands	12.9	Typically located on floodplain areas directly adjacent to the river corridor, and/or separated by an upland low terrace feature. Several wetland features were characterized by a linear, channel-like depression possibly derived from a relic (or current) flood channel. Not all wetland areas had a visible connection to the river, indicating that hydrology at these locations is driven by groundwater, rather than maintained by seasonal flood flows. In some cases, surface	These adjacent or “flood-plain” wetlands are categorized as Palustrine Emergent (PEM), Palustrine Scrub-Shrub (PSS) or Palustrine Forested (PFO). If tree and shrub cover was greater than 30 percent, the wetland was classified as PSS, otherwise PEM was assigned to reflect dominance by herbaceous (emergent) vegetation. Based on the prevalence of hydrophytic vegetation, and presence (or lack) of surface water present at each site (during the dry season), it is likely that these wetlands are best described

Table 6: Field-mapped Wetlands within the Active Project Area

Type	Description	Acres	Description	Cowardin Classification
			flow from the main river channel was observed, indicating that seasonal high flows are likely to migrate onto some floodplain areas occupied by wetlands. A linear, channel-like wet depression (the lowest point of each wetland area) holding surface water was observed frequently in most wetland areas. In all cases, wetland areas displayed indicators of vegetation, soils and hydrology. These wetlands would be classified as DEPRESSIONAL wetlands under the HGM system (USDA 2008).	as Temporarily Flooded (A), Saturated (B), Seasonally Flooded (C), Seasonally Flooded/Saturated (E), or F (Semi-permanently Flooded) (Cowardin et al. 1979).

2 Impacts Analysis

2.1 Introduction

The following is a site-specific analysis of the potential direct and indirect impacts of this project on hydrology, flooding, water quality and quantity, and wetlands.

Several management directives/recommendations apply to this project, including management directives from the 1990 Wallowa-Whitman Land and Resource Management Plan (WWNF 1990), Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH 1995)[2]; the Land and Resource Management Plan Biological Opinions (1998); and the Biological Opinion for Endangered Species Act Section 7 Formal Consultation. In addition, the PACFISH amendments add further interim management direction in the form of Riparian Management Objectives, Riparian Habitat Conservation Areas and standards and guidelines. Executive Order (EO) 11988 requires the U.S. Forest Service (USFS) to "avoid to the extent possible the long and short term adverse impacts associated with the occupation or modification of floodplains." EO 11990 requires the USFS to "avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands." Conservation measures and best management practices (BMPs) that would be followed during design and construction of the project have been included in this analysis and are described in the Alternatives Description section of the EA.

Two activity areas have been identified for this project: the active project area (Figure 7) and the log source area, which includes areas where trees would be harvested on private land in the hills south of the project area (Figure 8). The active project area is approximately 293 acres and includes the channel modifications, storage and staging areas, temporary roads, and one tree harvest and staging area on the south side of Highway 244. The log source area includes 982 acres of upland forests located a few miles south of the project area in the Bear, Dog, Jordan, and Beaver creek drainages, where the majority of trees would be harvested (Figure 8). The area of analysis includes the activity areas plus the area of potential impacts associated with the action. This analysis area varies depending on the resource considered. For

[2] Amended the Wallowa-Whitman Forest Plan

example, water resource impacts are considered within the activity area and include the area downstream that could be impacted by the action, while cumulative impacts have been considered regionally.

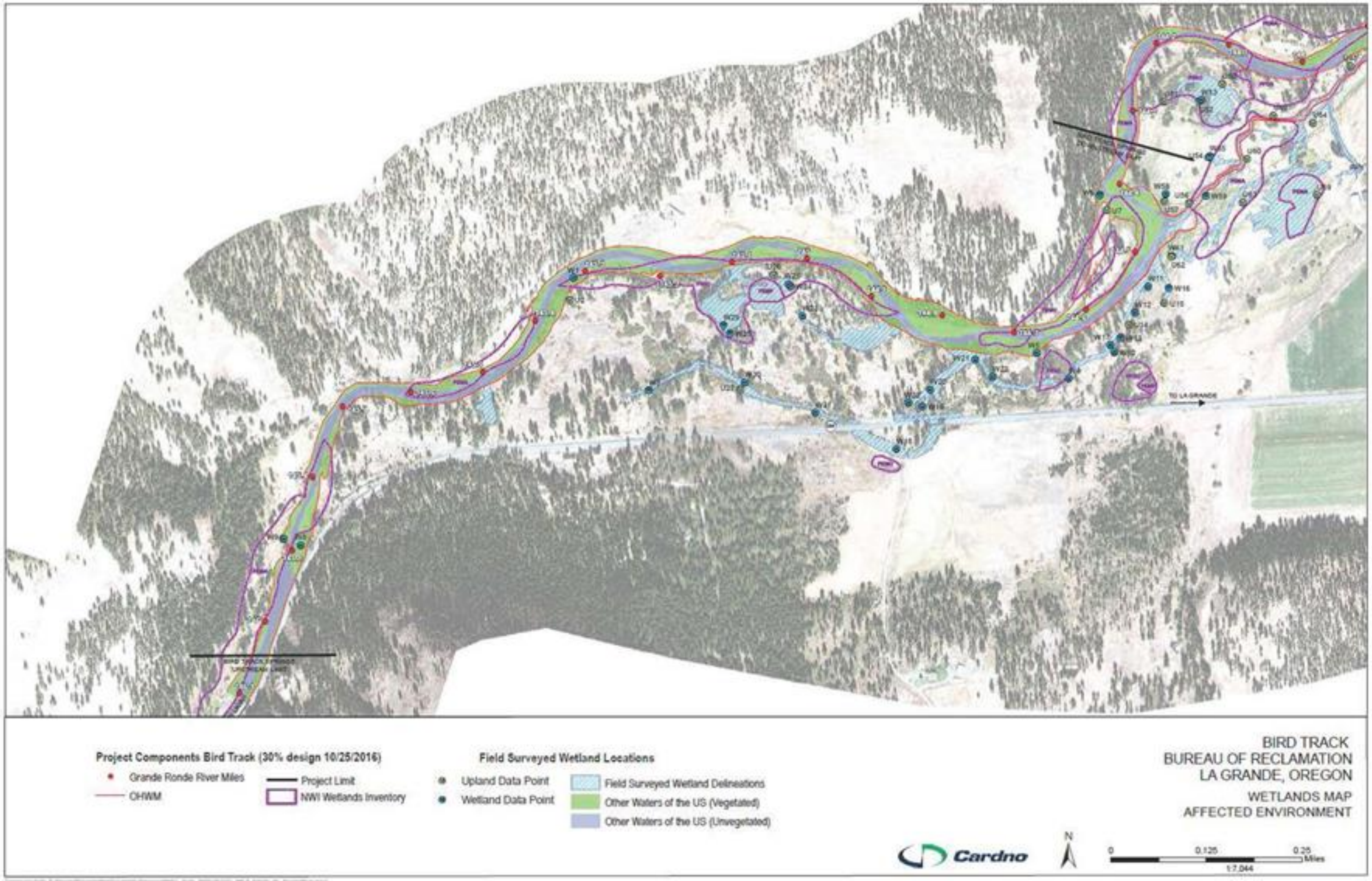

Figure 7. Active project area showing wetland features.

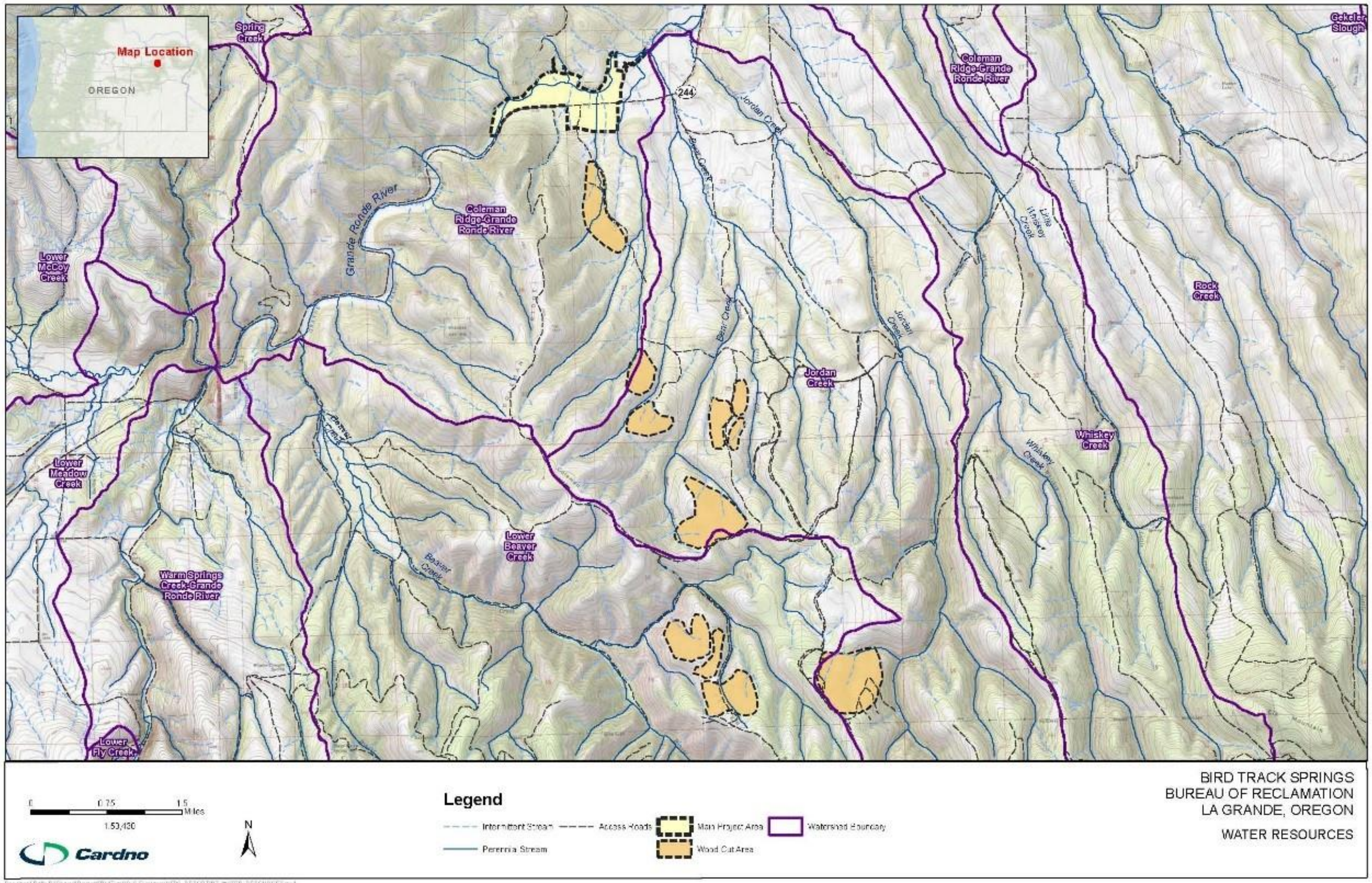

Figure 8. Log source areas showing streams and access roads.

2.2 Methods and Assumptions

The description of watershed resources, along with the analysis of the expected and potential impacts for each alternative were assessed using field surveys, water quality databases, current scientific literature presented herein, and professional judgment. Site-specific research, field data collection, and modeling were conducted in support of the Bird Track Springs project design and included studies on hydrology, geomorphology, wetlands, and groundwater. Hydraulic modeling was conducted by Cardno and Reclamation to estimate existing conditions and project impacts. Where available, quantitative data were used in the impacts analysis. Key indicators for the analysis include:

- Changes in flows
- Changes in channel length and sinuosity
- Changes in area flooded by the 10-year return interval event
- Changes in water quality (turbidity, water temperature)
- Changes in area of wetlands

Project impacts and potential changes in key resource indicators have been estimated for two timeframes: short and long term. Short-term impacts generally include the period during and immediately after construction, but could last up to 2 years from the start of the project. Long-term impacts include the period of time between the end of short-term impacts and approximately 5 to 25 years in the future.

The impact analysis assumes that near-future conditions would be similar to those in the recent past (for hydrologic and hydraulic modeling purposes), that rare flood events are unlikely to occur during construction, and that BMPs and mitigations would be applied, monitored, and function as designed and corrective actions would be applied if they were found not to be functioning as intended. The Management Requirements, Constraints, Design Criteria and Conservation Measures section in the Alternatives Description Section of the EA describes the conservation measures that apply to this project. The conservation measures that apply directly to water resources are included in the General Aquatic Conservation Measures subsection. Additional measures that would protect water quality are found under the Soils, Fisheries, River, Stream Floodplain, and Wetland Restoration sections.

3 Direct and Indirect Impacts

3.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, the restoration project would not occur in the floodplain and trees would not be harvested in the log source area. Activity on National Forest lands would continue to be governed by the current land management and transportation plans, and could include agency actions such as road maintenance, noxious weed treatments, and public activities such as fuel-wood removal, mining, and recreation. Activities on private lands would continue and could include actions such as grazing, timber removal, vegetation management, and recreation. Other Reclamation restoration projects would likely be considered along the GRR.

The existing conditions at the site are considered degraded from a fish habitat perspective when compared to likely historical conditions (Fisheries and Aquatics section of the EA). As described in the Affected Environment section, historical land use and river disturbances have created conditions of high water temperatures, low stream flows, simplified habitat, and limited off-channel habitat that negatively affect native salmonid populations. The abandoned railroad grade acts as a barrier to natural floodplain inundation within the reach.

Without the proposed project, the existing conditions are likely to persist, resulting in continued degraded habitat and warmer water temperatures.

3.2 Alternative 2 – Proposed Action

A detailed description of the proposed action is provided in the Proposed Action and Alternatives section. Proposed activities in the project area that could impact water resources include:

- Temporary access road construction and use
- Staging area construction and use
- Grubbing, grading, cutting, and filling
- New channel construction and back-filling yielding a new channel configuration
- Changes in floodplain vegetation, elevations, and connectivity to the GRR
- Placement of logs, boulders, rock, and fill
- Potential leaks and spills from construction equipment

With the exception of logs, some large boulders, additional rock, native seeds, and potted native plants, all materials used for the project would be from within the project site and repurposed in construction of new channel features and floodplain elements. Existing boulder-rock weirs would be removed and boulders repurposed as habitat features or structural ballast. Abandoned reaches of the existing channel would be filled using excavated material from constructed channel segments. Existing riparian vegetation, topsoil, shrubs, and trees that require removal would be salvaged and reused in the floodplain. At this time, it is not expected that any native materials would be removed from the project site. Non-native materials (trash, noxious weeds, etc.) would be removed if found during construction and disposed of at a permitted dump site.

Changes in channel dimensions and floodplain connectivity could alter downstream flows, subsurface flows, and groundwater connectivity. Earth-moving activities, access road construction, and construction and use of staging areas could impact subsurface flows and wetlands through compaction. The extent and magnitude of flooding would be affected by the proposed project by increasing channel sinuosity and roughness as well as increasing vegetation and contours of the existing floodplain. Water quality could be affected during construction by erosion, sedimentation, leaks, and spills from construction equipment. Longer-term water quality impacts include changes in temperatures and the possibility of continued erosion if the channel continues to adjust for a period of 5 to 10 years. Impacts can be both positive and negative, and the overall goal of the project is to create positive impacts to benefit salmonid species. Resource impacts are described in more detail in the following sections.

3.2.1 Hydrology

Hydrologic changes as a result of this project would be local and minor since the project area and proposed action are not large enough to influence regional hydrologic processes. Precipitation and the flow regime at the upstream boundary would not change as a result of the project. Changes in flow patterns through the reach from the proposed changes in channel length (an increase of 1,100 feet), sinuosity (an increase of 0.13), slope (a 0.05 percent decrease), and floodplain connections would result in slower flows through the reach, increasing ponding, hyporheic flows, and groundwater infiltration, which are objectives of the project.

In some areas where the water table is near the surface, construction traffic may cause short-term soil compaction and reduced subsurface flows. Compaction is expected to occur near the surface and would be a highly localized impact, as the depth to bedrock ranges from 23 to 28 feet in the project reach. Increased ponding upstream of access roads or staging areas may occur, but would be offset by scarification after the project is completed.

Approximately 42 acres, or 14 percent of the active project area, would be used for access roads, staging, and storage areas. All access roads, staging, and storage would be obliterated at project completion, and if any of these features occur in wet areas they would be obliterated by the end of the in-water work window. Ultimately, the increased frequency of inundation would result in deposition of additional sediment and soils, increased moisture retention, and increased vegetation establishment. No impacts to hydrology are expected in the log source areas due to the low density of harvest and distance from riparian areas and streams.

3.2.2 Flooding

One of the project objectives is to increase floodplain connectivity to the GRR; changes in area flooded within the active project area are expected and would be local in effect. No changes to flooding are expected in the log source areas. The area affected by the 2-year flood in the active project area is expected to increase 67 percent to approximately110 acres, and the area affected by the modeled 10-year flood is expected to increase 60 percent to 115 to 176 acres (Figure 9). The project would generate approximately 70,630 cubic yards of cut material from the stream channel work. Of this, 69,030 cubic yards would be used on-site to fill the old channel, and 1,600 cubic yards would be disposed of off-site, resulting in a net reduction of material in the project area floodplain. Floodplain function would also improve in the long term with a reduction in ice scour that would be accomplished by increasing channel complexity and floodplain vegetation. Overall, floodplain function and quality would increase, especially once the revegetated areas become established.

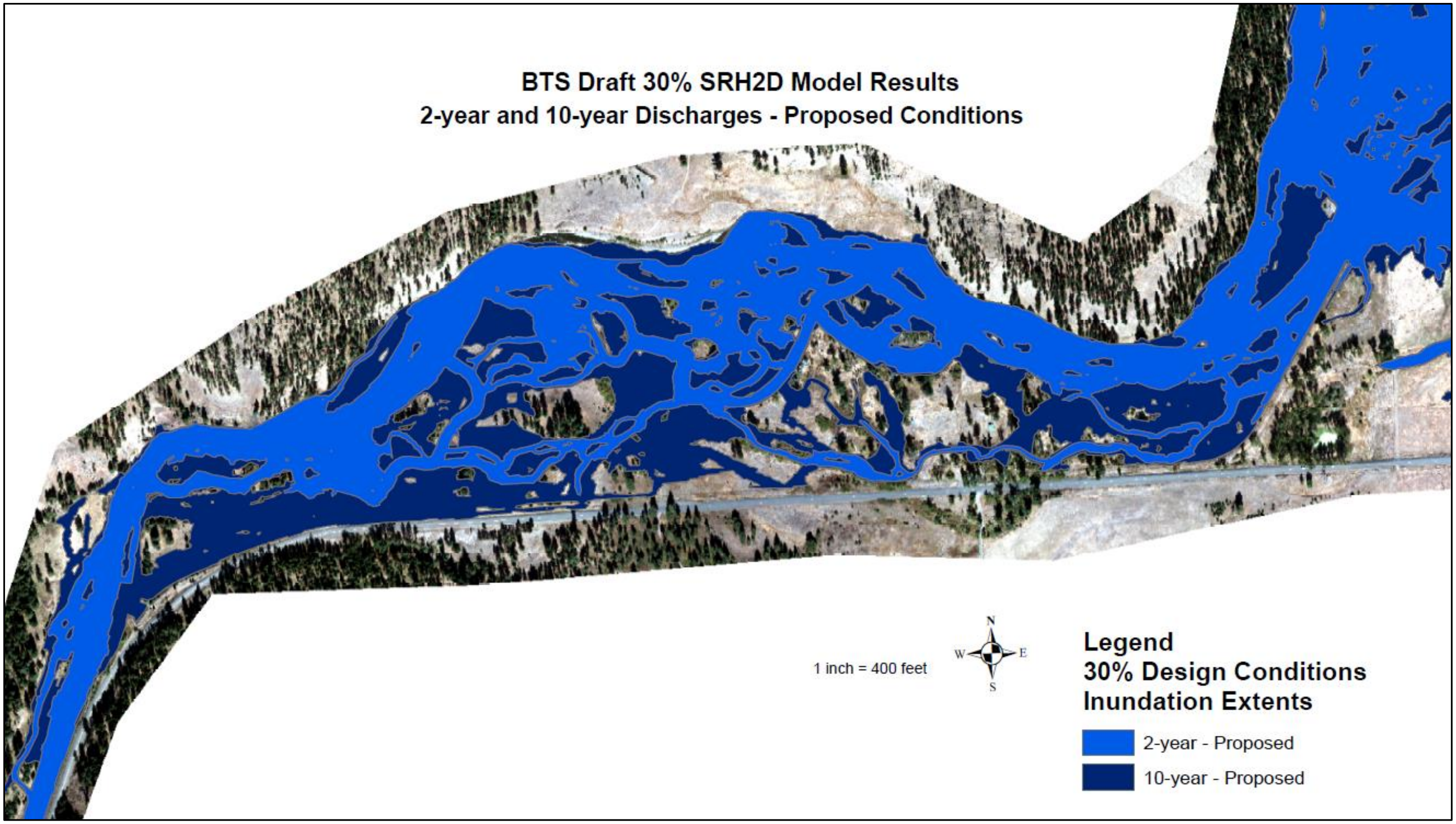

Figure 9. Modeled inundation of the floodplain for draft 30 percent design for the 2- and 10-year flood event.

As part of the project design, hydraulic modeling was performed to analyze inundation limits and water surface elevations upstream, through the project reach, and downstream. Comparing the existing conditions water surface elevations to the proposed conditions water surface elevations downstream of the project limits shows the project does not increase water surface elevations downstream (Cardno 2016a). Modeling results for the 100-year flood indicate a slight reduction in flooded area north of the channel and in the Bear Creek Ranch area due to improved channel flows (Cardno 2016a).

The active project area is located within a basin that is predominantly forest lands with limited development; however, there is some development within the floodplain of the active project area. South of the GRR is the Ukiah-Hilgard Highway (Highway 244), which is within the active floodplain. The highway is a two-lane paved road maintained by Oregon Department of Transportation. Between the highway and the river, directly north of the Bird Track Springs Campground, is a series of trails that run through the floodplain, which would be relocated as part of the proposed project. The trailhead is located at the highway turnout directly across from the campground entrance.

Within the Lowe Family and Bear Creek Ranches, there are a handful of barn-type structures, as well as a corral on the Lowe Family Ranch. This corral is intended to be relocated as part of this project. The project's estimated flood risk is "low" for floodplain structures (Cardno 2016a).

There are no instream structures or infrastructure within the project reach or immediately downstream of the project reach. The nearest downstream bridge, at the interchange of Highway 244 and Interstate 84, is approximately 6 miles downstream and would not likely be affected by project activities. There is a possibility that large wood from the site could migrate downstream over the long term, but it could be deposited at any point along the 6 miles between the project site and the bridge and would be of insufficient quantity to cause a blockage at the bridge. The proposed project would also increase the likelihood that wood migrating downstream from above the project reach would become trapped in the project reach.

No changes in flood frequency or inundation would occur along streams in the log source areas or for the GRR because there would be no changes to streams or flows in the log source watersheds from low-density harvest.

3.2.3 Water Quality

The Upper GRR is currently operating under a TMDL and Water Quality Management Plan approved in 2000 for temperature, dissolved oxygen, algae, nutrients, pH, sedimentation, bacteria, and habitat and flow modification. The plan relies largely on habitat restoration to achieve water quality improvements, and the proposed project would contribute to improvement in water quality for most of the elements with the possible exception of bacteria. This would be achieved by increasing complexity in the channel and floodplain, increasing shade in the long term to help reduce temperatures, and trapping sediment in the reconnected floodplain.

Direct, short-term impacts to water quality impacts could occur during construction and channel rewatering. The primary concern would be sedimentation associated with earth-moving activities in and around the GRR. Construction would be phased over 2 years and occur near the in-water work window in July, which is one of the least rainy months of the year. Active construction and earth moving would expose soils to splash, sheet, rill, and gully erosion if a significant rain event were to occur. A stormwater pollution prevention plan (SWPPP) following the Habitat Improvement Program (HIP) III protocol would be prepared and followed to reduce and mitigate soil erosion and to prevent sedimentation from entering waterways. Turbidity monitoring, in accordance with the HIP III protocol, would occur during construction and if an exceedance occurred (>10 percent background), activities would stop until levels returned to background. If at any time it is determined that the turbidity controls are ineffective, sediment control measures would be repaired, replaced, or reinforced. Potential impacts from soil erosion and sedimentation are described in more detail in the soils section. If the conservation measures are implemented as directed, direct negative water quality impacts to the GRR would be minimal, and indirect impacts would be positive as floodplain functions are restored.

Log source areas, roads, landings, and skid trails would be seeded with a native seed mix at the conclusion of actives to provide erosion control. In addition, waterbars and slash would be placed on skid trails where needed. No harvest would occur in or near riparian areas or streams, and impacts to water quality are expected to be minimal.

3.2.4 Wetlands

Existing wetlands within the active project area were avoided to the extent practicable during the design process; however, some wetland impacts would occur during construction. Direct impacts include temporary disturbance to wetland vegetation (vegetation cut at ground level), compaction of wetland soils, and temporary alteration of wetland hydrology. In some cases, access roads or the new channel impinged on mapped floodplain wetlands; however these impacts would be less than an acre of floodplain wetlands in the project area (7.5 percent of floodplain wetlands) (Figure 10, Table 7). A total of 20.95 acres of riverine wetlands could be affected by new channel construction and filling of the old channel (61 percent), but these would be restored and reestablished with the proposed channel design.

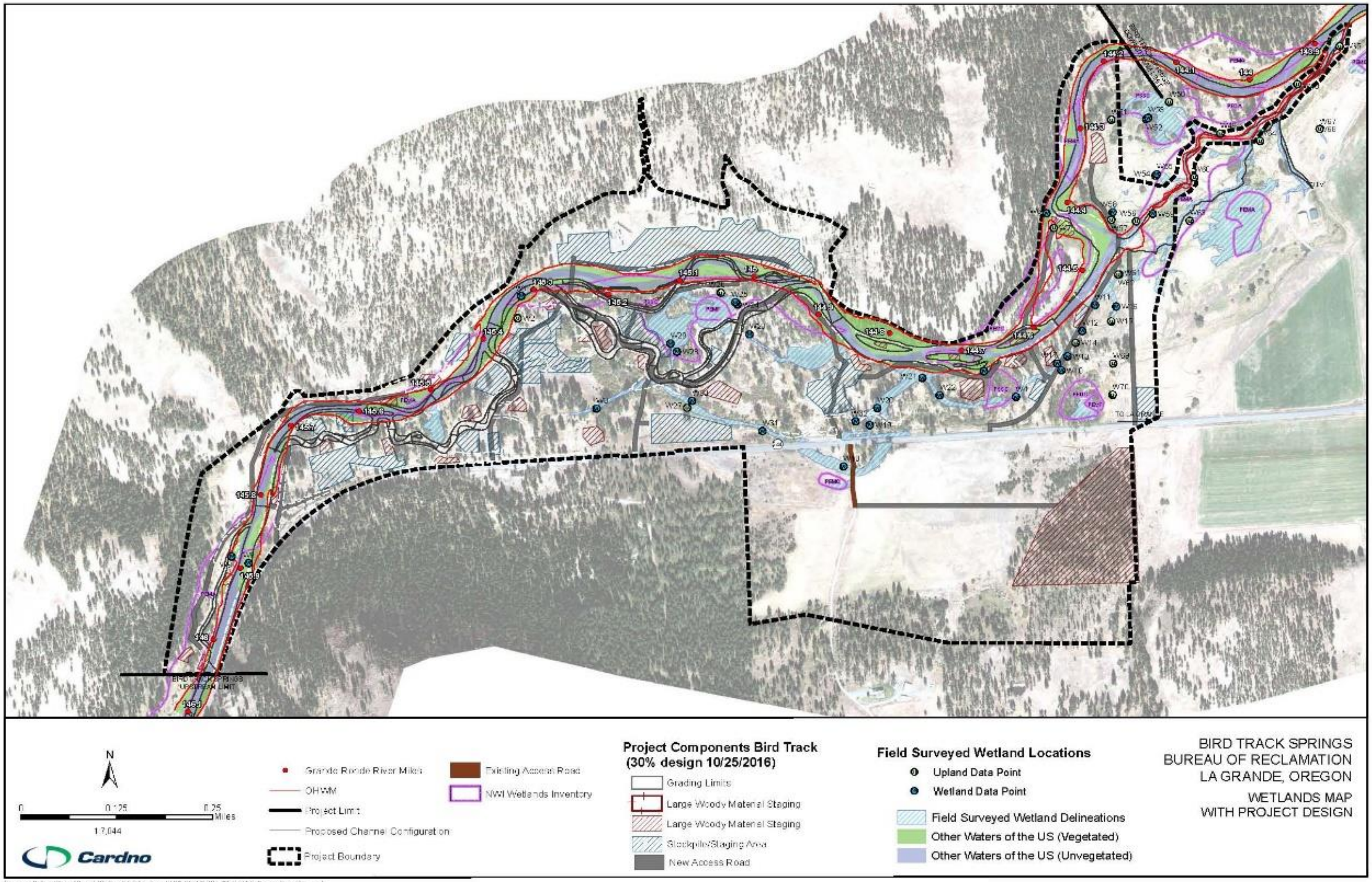

Figure 10. NWI wetlands and field-mapped wetlands with project elements.

Table 7: Field-mapped Wetlands Affected by Project Activities (acres)

Project Element	Unvegetated Other Waters	Vegetated Other Waters	Floodplain Wetlands	Grand Total
Bar (Constructed)	0.963	2.187	0.004	3.15
New channel design	8.919	6.423	0.268	15.61
Existing Access Road			0.031	0.031
New Access Road	0.128	1.313	0.480	1.92
Staging and Storage Area	0.037	0.979	0.147	1.16
Total	**10.047**	**10.903**	**0.930**	**21.88**

Although construction and new channel design may result in impacts to existing vegetated wetlands along the banks of the GRR and adjacent depressional wetlands within the floodplain, the proposed design would replace these wetlands and create new riverine wetlands along the new channel, enhance floodplain connectivity, and increase the frequency and the size of the area flooded, thereby resulting in in-kind replacement or possibly a net increase in quantity of wetlands acreage. For example, increased inundation from the 2-year peak flow would enhance groundwater recharge, sustaining riparian vegetation, net deposition of fine sediment, and dissipation of ice jams. Those changes in combination with the revegetation plan, would restore and possibly enhance impacted wetlands across the site, resulting in beneficial impacts to wetlands along this section of the GRR. There are no wetlands within the log source area boundaries; therefore, no wetlands would be impacted.

All direct negative impacts to wetlands associated with project construction would be short term and all disturbed areas would be restored following construction. Furthermore, construction would be followed by implementation of an approved planting plan to restabilize and revegetate disturbed wetlands. All project-related construction would follow the resource management guidelines and BMPs identified in the Management Requirements, Constraints, Design Criteria, and Conservation Measures identified above to minimize temporary negative impacts to wetlands.

Long-term indirect wetland impacts associated with completion of the project would be beneficial. Enhancing floodplain connectivity and increasing the frequency and the size of the area flooded by the 10-year event by almost double would enhance the natural wetland function and formation process within the GRR floodplain. These indirect beneficial impacts could include additional mechanical and chemical filtration, bank and floodplain stability, energy reduction and dissipation, and increase in wetland value as a result of increased connectivity to the floodplain and use by aquatic and terrestrial wildlife.

The proposed action would result in short-term direct impacts to wetlands, with long-term benefits in the active project area. No wetlands occur or would be impacted in the log source areas.

4 Cumulative Effects for Watershed Resources

Potential cumulative effects are analyzed by considering the proposed activities in the context of past, present, and reasonably foreseeable future actions. Reasonably foreseeable future actions are defined as activities that will occur within the next 5 years. For this project, activities are considered within the vicinity of the active project area and are described in Table 8.

4.1 Alternative 1 – No Action Alternative

The only reasonably foreseeable future actions that would overlap in time and space within this project area that may have a potential to have a short-term increase to water resource impacts would be off-highway vehicle (OHV) use, livestock grazing, and continued timber management on private lands.

In addition, the Longley Meadows Restoration Project is located immediately downstream of the Bird Track Springs project and is proposed to have similar restoration elements as this project.

4.2 Alternative 2 – Proposed Action

As with No Action Alternative, reasonably foreseeable cumulative actions that could affect water resources are described in Table 7 and include OHV use, livestock grazing, and timber management on private lands. The Longley Meadows Restoration Project, while different in its specifics, would also involve an intensive construction footprint on floodplain soils and the river channel. Overall, the Bird Track Springs project, in combination with other restoration projects on the Upper GRR is expected to have a positive impact to water quality and fish habitat.

Table 8: Cumulative Effects Determination Table for Water Resources

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Effects
		Time	Space		
Noxious Weed Management: Wallowa-Whitman Invasive Species Treatment Record of Decision	Reduction of invasive species competition	Yes	Yes	No	No impacts to water resources expected if spraying guidelines are followed.
Vegetation Management: Bird Track Springs precommercial thinning and prescribed burning		No	No	No	
Special Uses: OTEC Powerline Fly Fishing O/G Permit		Yes	Yes	No	Powerline is suspended over river; no impacts are expected from this powerline or fly fishing on the GRR.
Recreation: Bird Track Springs Interpretive Trail		Yes	Yes	No	This trail would be moved as a part of this project; therefore, this is direct/indirect impact, not cumulative.
Recreation: Dispersed camping		Yes	Yes	No	No impacts to water resources expected.
Recreation: Snowmobile trails		No	No	No	
Recreation: Firewood Cutting		Yes	Yes	No	No impacts to water resources expected.

Table 8: Cumulative Effects Determination Table for Water Resources

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Effects
		Time	Space		
Recreation: OHV Use		Yes	Yes	No	Unauthorized user-built OHV trails and OHV use is spread across most of the landscape within the Spring Creek area, contributing to sediment production. Water quality could be impacted in the short term, but the long-term benefits of the project and implementation of travel management within the project area would yield a net improvement in sedimentation rates and water quality.
Recreation: Bird Track Springs Campground		Yes	Yes	No	Campground is separated from the GRR by Highway 244. Recreation activities within the campground have no impact on the project area.
Roads & Trails: Travel Management Plan		Yes	Yes	No	See OHV use above.
Road Maintenance on Highway 244		Yes	Yes	No	No impacts to water resources expected.
Roads: Danger Tree Removal		Yes	Yes	No	No impacts to water resources expected.
Grazing Allotment: Spring Creek Sheep Allotment		No	No	No	
Fisheries Enhancement: Fish logs from Bird Track Springs Campground Longley Meadows	Short-term water quality impacts from restoration construction activities possible	Yes	Yes	Bird Track Springs Campground – No Longley Meadows – Yes	Some large tree removal is planned within the campground area for another fish enhancement project. Trees would be cut down, loaded with a log forwarder, and hauled off-site. Most of the removal is expected to occur from existing roads and no water resource impacts are anticipated. Longley Meadows project would have similar short-term impacts to those described above for this project. Long-term impacts are expected to be minimal.
Wildlife Enhancement: GG Owl Platforms Aspen Enhancement		No	No	No	
Mining		No	No	No	
Private Land		Yes	Yes	Structures –	Grazing – An existing corral on the private property portion of the active

Table 8: Cumulative Effects Determination Table for Water Resources

Project	Potential Effects	Overlap in:		Measurable Cumulative Effect?	Effects
		Time	Space		
Activities: Private Structures Roads Grazing				No Roads – No Grazing – Yes	project area would be moved out of the project area, reducing potential livestock impacts on water quality.

4.2.1.1 Water Quality Compliance Statement, Floodplains and Wetlands Executive Orders

Compliance Statement

Floodplains, Executive Order 11988

EO 11988 requires the USFS to "avoid to the extent possible the long and short term adverse impacts associated with the occupation or modification of floodplains." This project would benefit the floodplain by connecting it back to the stream and watershed.

4.2.1.1.1 Wetlands, Executive Order 11990

EO 11990 requires the USFS to "avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands." This project is consistent with this EO because it would enhance natural wetland function and formation process within the GRR floodplain. These beneficial impacts could include additional mechanical and chemical filtration, bank and floodplain stability, energy reduction and dissipation, and increase in wetland value for use by aquatic and terrestrial wildlife.

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